Red Team Review Charter
For the
MAP Mission
Approved 4/28/00
Revision A 7/24/00
Revision B 7/27/00

Revision Record

Revision	Date	Explanation/Location
A	7/24/00	The last four bullets of subparagraph 4 on page 7 were added at the direction of the Director of Systems Safety and Mission Assurance in order to add more emphasis to the software IV&V evaluation. The first sentence of the paragraph following these bullets was changed to add FTA and IV&V
B	7/27/00	Table 2 on page 9 was corrected to read "Phase 2". Table 1 on page 8 and Table 2 on page 10 were expanded in the Comments column to clarify the Red Team participation for the alternative approaches for presenting for the Mission Launch Services Review and Special Review (i.e. Contractor or KSC).

Red Team Review Charter
for the
MAP Mission

1. Background

In the light of some recent NASA mission failures and the resulting Failure Review Board findings, the NASA Administrator has requested that the Center Director conduct critical Red Team Reviews on each of the Center's missions prior to the mission launch. This review is to go beyond a review of the project documentation of what was done and into technical aspects of the program and the remaining risk.

2. Objective

The objective of this review will be to enhance the probability of the MAP mission success by bringing to bear additional technical expertise to review all mission critical aspects of the program implementation.

3. Scope

The mission elements that will be addressed by the Red Team Review, and the depth to which each element will be addressed, shall be as follows:

- Spacecraft-fully addressed
- Payload-fully addressed
- Launch preparations, launch event and launch support-fully addressed
- Launch vehicle integration-fully addressed
- Launch vehicle mission unique changes-fully addressed
- Readiness for on orbit operations-fully addressed
- Unique-to-mission changes to the ground station-fully addressed
- Launch vehicle assigned to each mission - evaluation of the mission launch vehicle service as presented at the Design Certification Review (DCR) and the Pre-Ship Review for the MAP mission; also included are 4 special topics included in Table 2.
- SOMO/institutional mission operations-addressed on a mission unique requirements basis only
- Mission science operations-limited to systems needed for data capture, processing, archiving and distribution only

4. Red Team Review Process

The MAP Red Team Reviews shall consist of a critical technical implementation and operations review on the mission implementation from the perspective of looking at what could go wrong and cause the mission to be less than fully successful. Specific key processes used by the project in the implementation of the mission shall be reviewed. The results of some of these key processes will be reviewed and assessed as well. From this information the Red Team shall identify and document all remaining risk that could be in-line with complete mission success.

The Red Team shall have a membership that is external to the GSFC and is independent of MAP Project personnel. The Team will function as an overview team that can assign functions and work to specialized technical teams as appropriate. These specialized teams may be supported by the MAP mission/ contractor personnel and will report in this

capacity to the Red Team Chairperson. The core Red Team however, is solely responsible for the implementation of the Red Team Reviews and shall request mission and contractor support as necessary.

To facilitate coordination of the review of launch vehicle services, the Kennedy Space Center has agreed to provide two external, independent members to the team, namely a management expert and a technical expert to serve on the Red Team. The management expert will serve as the co-coordinating focal point with KSC for launch vehicle service related matters and will report to the Red Team Chairman.

The MAP mission and KSC shall be required to assemble all pertinent information (using specific formats agreed to by the Red Team Chairperson) and present that information to the Red Team. The Red Team shall have the authority to request that the mission/ KSC prepare all necessary documentation and other records to enable and otherwise support these reviews. The mission and KSC shall also arrange for the cognizant peer review and systems review chairpersons to present the methodologies and findings of the individual peer reviews to the Red Team. The Red Team Reviews are listed in Table 1. Figure 1 is a summary flowchart of the same reviews.

5. Review Process Specifics (Applicable to Spacecraft & Instruments only)

5.1 The following paragraph listing 13 specific items applies to the review of the mission spacecraft and instruments only and does not apply to the Launch Vehicle Service Review.

The mission shall prepare, assemble, and present data in specified formats, that addresses (or provides) the following:

1. The level, competence and independence of technical peer reviews that were performed on each of the elements and components (hardware and software)

2. The performance, level and independence of system level reviews that were conducted (hardware and software).

3. The level and thoroughness to which the test and verification program was implemented. The test and verification program at all levels from black box to spacecraft and integrated mission shall be detailed. This shall also include the V&V and IV&V processes used on software.

4. The level of mission assurance that was imposed on the implementation of the mission (hardware and software). This shall include parts usage as well as workmanship standards imposed. It shall also address the software assurance processes implemented.

5. The systems management imposed and implemented for the mission. This shall include the performance and thoroughness of analyses, requirement management, systems engineering, software metrics, configuration management, documentation and technical record keeping and workmanship and test process management.

6. Factors such as staffing and the experience of the implementing organization.

7. The results of the test and integration process of all of the hardware and software elements of the mission. This shall include information on the review and assessment of all failures and anomalies and their resolution.

8. Information on the failure-free as well as the total operating time on all mission critical hardware and software.

9. The results of the technical review process shall be detailed. It shall include an assessment of all RFA's and the Project responses to those RFA's.

10. The amount, level and fidelity of mission simulations and launch/operations training that was done or is planned to be done to prepare the mission for launch and on orbit operations including identification of all planned contingency operations and of those operations which were practiced by the ops team. Identify any green card exercises (postulated mission contingencies which require action by the ops team) planned or conducted with the ops team. Provide a spacecraft mission timeline from liftoff to commencement of normal science operations and identify for each step the corrective action to be taken if the mission event does not occur as planned.

11. Provide a subsystem level Failure Mode and Effects Analysis (FMEA); subsystems level Fault Tree Analysis (FTA) and a Probability Risk Assessment (PRA) performed at a subsystem level.

12. Provide a mission requirements Verification Matrix that shows the pre launch verification of the mission level requirements. This matrix shall address both the fidelity and type of verification.

13. Identify all single point failures and provide an assessment of the probability of each such failure mode causing a mission failure. Also provide adequate rationale to substantiate the assessment.

5.2 Phased Review of Specific Processes

The 13 items above can be characterized as falling into two phases, namely planning and implementation results. For this reason, the Red Team will review certain of the items in what will be called the Phase 1 Review and the remaining items will be covered in the Phase 2 Review. The following is a listing by subparagraph number of those processes that will be covered in each review.

Phase 1 Review (Process List)

1,2,3 (plans), 4, 5, 6, 9, 10 (plans), 11, 12 (plans), and 13

Phase 2 Review (Process List)

3 (results), 7, 8, 10 (results), 12 (results)

6. Review Process Specifics (Launch Vehicle Service Only)

Representatives of the launch services organization shall prepare, assemble, and present data in specified formats, that addresses (or provides) the information defined in Table 2 of this charter. The team requires the Launch Vehicle Service to present the standard items normally addressed in the Delta Pre-Ship Review (PSR) that are listed in Table 2, and augmented by the four additional items identified in bold type. Since the majority of the content required by the Red Team is standard for the Delta PSR, the presentation to the Red Team need only add the additional 4 items for the Red Team, plus any clarifications or expansions on the listed items as required by the Red Team. The Red Team Chairman prefers that selected members of the Red Team attend the Delta PSR and DCR; should KSC object to Red Team attendance, KSC will present the required material to the Red Team.

In reviewing the above spacecraft and launch vehicle service items, the Red Team will focus on implementations that could contain unevaluated risk to mission success.

7.In performing this task, the Red Team shall do the following:

1. Document the above review investigations in a summary matrix that indicates actual level of performance achieved on each of the above items. This should take into account the level of difficulty and complexity of each mission. Each of the **spacecraft** items shall be rated on a scale of 1 to 10 with 10 being a very superior implementation and 7 being judged as nominal expected for assuring a remaining residual risk judged to be categorized as low. Each and every lapse in adequate implementation (a scoring of 6 or lower), even if the overall implementation is judged as being adequate, shall be identified and documented and judged under Item #2 below. Potential viable mitigation of remaining risk shall also be addressed if applicable. **Launch Vehicle Service** reviews will address the content described in Table 2 and the evaluations will be categorized as low, medium, or high.

2. Ascertain and document all residual risks, judged to be any level higher than low, that are remaining in the mission. Provide recommendations on methods and implementations to mitigate these identified higher-than-low risks.

3. Assess all spacecraft single point failure mechanisms and provide a recommendation on the acceptability of non-acceptability, with appropriate rationale for each judgment.

4. Assess the spacecraft and launch service mission-unique FMEA, FTA and PRA for completeness. Where these analyses have not been performed or are not complete, the Team shall assess the work that has been done and shall assess the current situation in regards to available data for doing a FTA and a PRA for elements of this mission.
   Specifically, in the Final Report**, given the current state of the MAP Mission implementation,** provide answers, to the following questions:
   - Can a meaningful FTA and/or PRA be performed at this stage of the MAP mission implementation, especially in regards to data and personnel availability?

- If a FTA and/or a PRA were to be performed prior to the final decision to launch, what schedule impacts and costs of actual FTA and PRA performance would be associated with this work?
- Would the performance of a PRA at this time add significantly to our knowledge of the risks of failure already derived from other assessments?
- From a practical standpoint, can the probability of mission success be significantly enhanced by knowledge derived from the performance of a FTA and/or a PRA at this time?
- Can a meaningful IV&V be performed at this stage of the SORCE mission implementation, especially in regards to data and personnel availability?
- If an IV&V were to be performed prior to the final decision to launch, what schedule impacts and costs of actual IV&V performance would be associated with this work?
- Would the performance of an IV&V at this time add significantly to our knowledge of the risks of failure already derived from other assessments?
- From a practical standpoint, can the probability of mission success be significantly enhanced by knowledge derived from the performance of an IV&V?

If a PRA/FTA or an IV&-V ~~has~~ have -not been done, the Red Team shall review (or develop) other available, relevant information and assign subjective levels of probability of occurrence and mission risk (criticality) to each identified mission failure mode. This shall be done using the 5X5 matrix used on the IMAGE Red Team, with categorizations for low, medium, and high risk.

5. Provide a report in the form of a presentation on all of the above to the Center Director and the Goddard Program Management Council in approximately two weeks of completing the full review of each mission (actual date to be scheduled). This shall include an overall mission risk statement, along with the justification for that statement.
6. Provide a written report within one week of the presentation to the Goddard PMC. This report can consist of the presentation charts used for the Goddard PMC presentation along with a cover letter and attachments that provide details of the specific review methodologies used by the Red Team along with any other pertinent information. This report shall be submitted to the Director of the Office of Systems Safety and Mission Assurance (Code 300) at the Goddard Space Flight Center.

Table 1
MAP Red Team Reviews

#	Review Summary	Comments
1	**Phase One Review** Mission Orientation plus review of those processes listed under Phase 1 in paragraph 5.2	Could be combined with mission PER provided it includes Orientation & Phase 1 specific processes in paragraph 5.2 of this charter
2	**Phase Two Review** (Essentially the same content as the mission Pre-Ship Review plus those processes listed under Phase 2 in paragraph 5.2 as well as Launch Vehicle Service mission-uniques)	Could be combined with mission PSR provided it includes the Launch Vehicle Service Mission-Uniques and Phase 2 specific processes in paragraph 5.2 of this charter
3	**Mission Launch Vehicle Service Reviews**	Selected members of the Red Team will conduct or attend these reviews 1. Pre-Ship Review content plus 4 added topics 2. DCR content for new Delta configuration 7425-10

Table 2
MAP Launch Vehicle Service Reviews Content

Review	Content required by the Red Team	Comment
Phase ~~1~~ 2 Review (Mission Uniques)	• Requirements • Designs • Mission Peculiar Analyses • Systems Engineering activities related to mission specific Integration, mission analysis, risk identification & mitigation • Mission integration process, history, and participants as well as any unresolved issues • Verification Plan & History for requirements and verifications levied by the launch vehicle service on the payload • Anomalies • Current status	Should be Included in the **Phase ~~1~~ 2 Review** for the mission.

Table 2
MAP Launch Vehicle Service Reviews Content

Review	Content required by the Red Team	Comment
Mission Launch Vehicle Service Review	1. Mission Description 2. Mission Peculiar analyses **3. Mission–specific systems engineering activities including risk identification and mitigation** **4. Comparison of the vehicle performance required for this mission with the vehicle's historical performance** 5. **Level and competence of peer and systems reviews related specifically to the mission. Summary of recommendations for action**. 6. Vehicle Checkout Activities - Vehicle Status - Chronology of Vehicle processing 7. Launch Site Plan – Status & Schedule 8. Vehicle Hardware History Review of Propulsion, Electrical, Structures, mechanical systems, addressing the following: -NASA First Flight Items/ Qualification - Selected flight critical component rejection history - Non-Reproducible Failures - Field Replacements - Failure Analysis Updates - Special Attention Items - Alert Status - Flight anomaly update **9. Verification Plan & History for mission-unique requirements and verifications levied by payload on the core launch vehicle** 10. Vehicle Mission Software History Review 11. Open Items 12. Summary	For the Delta vehicle, it appears that except for items 3, 4, 5, & 9, this information is contained in the standard vehicle Pre-Ship Review. Selected members of the Red Team will ~~conduct this~~attend this review if it is presented by the Launch Vehicle Services Contractor. In that case, the items in bold may be presented by KSC at another time and location of their choosing. If KSC presents the entire Mission Launch Services briefing, the Red Team will conduct the review~~.~~
Special Review	The standard content for Delta Design Certification Review for vehicle configuration # 7425-10.	Selected members of the Red Team will conduct or attend this review (see above).

MAP
Red Team Review Summary
April 28, 2000

Figure 1

MAP Red Team Reviews